

THE NEED FOR PROBLEM-BASED LEARNING IN NIGERIAN SECONDARY SCHOOL CHEMISTRY LESSONS

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Abstract.

Education is a vital instrument for human capital development. Chemistry is one of the basic sciences responsible for development of any nation. Chemistry students are expected to be equipped with 21 century competences and skills. The purpose of this article is to stress the need for implementation of PBL in Nigerian secondary school chemistry lessons. Teaching and learning in Nigeria does not produce students with the required skills and competencies, because of traditional instructions by teachers, bad learning environment and inadequate facilities. PBL is a process in which students develop problem solving skills and flexible knowledge through collaborative and self-directed learning under teachers guide. The process also facilitates the learning of three levels of chemical representations and the students' alternative conceptions in chemistry. PBL was pioneered for medical students in the 60s, to relate the knowledge acquired in the university to students future professional practice. It was later extended to other sciences. PBL has its theoretical bases from Cognitivists and Constructivists psychologists. In conclusion, the authors suggested for implementation of PBL in Nigerian secondary schools. Therefore they will investigate how the process of its implementation in chemistry lessons with the aim of developing a suitable PBL Model for Nigeria.

Key words: Problem-Based Learning; Chemistry; Needs & Secondary schools.

INTRODUCTION

In a competitive knowledge based economy society, human resource development is vital for economic survival. Today employees are expected to be well equipped with new 21st century competencies and skills, which include: problem solving skills, communication skills, collaboration skills, critical thinking, entrepreneurship, creativity and innovativeness (Aminu, 2007). Nigeria needs quality education to meet the expectations of employers in the work places. Quality education is one that satisfies the basic learning needs and enriches the lives of learners and their overall experience of learning. It is acquired through creation of good learning environment, production of effective teachers who can produce motivated and interested students with the skills required in modern society (Adeyemi, 1990).

Nigeria needs to adapt active learning strategies for students to have greater accountability toward their learning. Chemistry teachers should work as facilitators of the learning process and designers of learning environment rather than purveyor of knowledge (Tan, Oon Seng 2003). The teachers are required to put more effort into lesson preparation. They should be trained for facilitation skills and should have a belief that Problem-based learning (PBL) is a better strategy and committed to its implementation for transition from traditional approach to PBL approach to be successful. Pedagogical practices in line with the challenges / needs of the 21st century education are adapted in most developed countries, for Nigeria to achieve the status of a developed country in 2020, a change in pedagogical practice is necessary to create fully equipped manpower to face the challenges of modern civilization (Tan Pin Yeen and Mohammad Yusof Arshad, 2011). There is a need for problem-based learning in Nigerian secondary schools education despite current issues in teaching and learning.

CURRENT ISSUES IN TEACHING AND LEARNING IN NIGERIAN SECONDARY SCHOOLS.

Teaching and learning in Nigerian secondary schools does not develop or produce student with the higher order thinking skills, problem solving skills and other competencies that are demanded from 21st century educational institutions (Das, 2009). Chemistry teachers still practice expository methods where students are not free to ask questions because of the

teachers' autocracy. Most teachers perceive their main roles as sole dispenser of knowledge and the commander in-chief of the class (Abdullahi, 1982). Teachers' inability to adapt active learning strategies could be associated with poor learning environment, inadequate learning facilities, poor teachers' welfare and lack of recognition for teachers compared to other professionals such as accountants, doctors and engineers in the same civil service. These had adverse effects on the quality of learning and products of secondary schools in Nigeria (Ibidapo-Obe, 2007).

In addition to that, no adequate laboratory practical work for students, teachers focus only on basic verifications of laws without emphasize on investigative approaches, students scientific innovations are not rewarded. Science teachers either discuss experiments verbally as alternative to practical work or demonstrate it for student to see without opportunity to manipulate equipment for skill (Ajaja, 2005). Therefore, there is a need for science teachers to adapt active learning methodology such as problem-based learning that requires students to solve authentic chemistry problems that are related to their experiences and future professional life. The authors will investigate the implementation process of PBL in Nigerian secondary school chemistry lessons and try to develop a model of PBL that is suitable for Nigerian environment.

WHAT IS PROBLEM-BASED LEARNING?

Problem-based learning is a student-centered pedagogy in which students learn through problem solving. The goals of PBL help students to develop flexible knowledge, effective problem solving skills, intrinsic motivation, collaborative and self-directed learning (Barrows and Tamblyn, 1980a). PBL is an active learning method in which students work in groups, identify what they already know, what they need to know, how and where to access new information about the problem. Students generate hypotheses, identify learning objectives, seek sources of knowledge / learning material, evaluate information obtained, reflect, integrate new knowledge and synthesize solutions to problems. Teacher facilitates learning by supporting, guiding student to focus on learning objectives, creating suitable learning environment and monitoring the learning process. PBL represents a paradigm shift from traditional teaching, to student-centered approach to learning in which students experience a problem as the stimulator and motivator for learning. The differences between the traditional

and the PBL approaches to learning can be represented by the three loci of preoccupation as shown in figure 2.2 (TanOon Seng,2003;Muhammad-Yusof ;Ahmad ;Hassan, &Tasir, 2009).

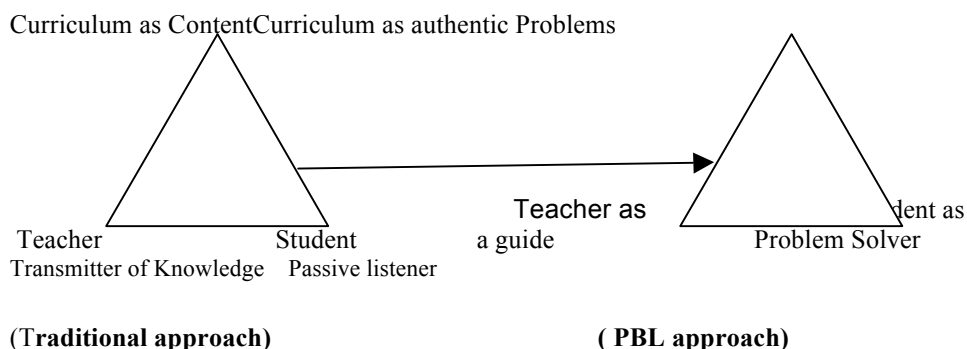


Fig.1,Differences between traditional and PBL approaches.

PBL is an inductive learning method,a better alternative strategy in teaching either at secondary schools or higher educational institutions, hence a major focus for educational researchers in the 21st century(JohariSurif; Nor Hassan Ibrahim and MohaniMokhtar, 2013).Including authors of this article.

THEORETICALFRAMEWORKOF PBL.

PBL was pioneered in the medical School in McMaster University, Canada in the late 1960s. The main factors that necessitated introduction of the PBL in the medical education at the University includes: The dissatisfaction of the learners with the traditional education, the irrelevance of the content knowledge to the learners future professional practice and the learners' inability to reason and apply what they have learned to solve problems at the work places(Barrows,1996).Problem-based learning was eventuallyexpanded to include education in the areas of sciences, engineering and other disciplines(Barrows and Tamblyn,1980; MacDonald and Isaacs, 2001; Knowles,1975 and Zimmerman, 1990). Although research revealed that PBL was practiced in America since 1993 and Asia, particularly in some tertiary institutions in Malaysia(Tan Pin Yeen and Mohammad YusofArshad,2014) there is no element of PBL in Nigerian secondary schools (Nwamnoand Izuagba, 2010). The authors will investigate the implementation process of the PBL in Nigerian secondary schools.

Learning is derived from learners'interactions with real problems and the learning environment; The process of inquirycreates cognitive dissonance that stimulates learning; Knowledge emerged from the collaborative processes of social negotiation and evaluation of

learners point of views (Dewey, 1963). PBL is not only about introducing problems into the classroom, but it is also about creating opportunities for learners to construct knowledge through interactions and inquiry (Norman and Schmidt 1993; Popper, 1992). Therefore, it is based on the constructivists' theory of learning (Schmidt, 1993; Savery & Duffy, 1995; Hendry & Murphy 1995). The goal of education is to help students develop problem-solving skills and creative thinking. A knowledgeable person is a problem solver, one who interacts with the environment in testing hypotheses, developing generalizations and engaging in learning to arrive at solution to problems (Bruner, 1960). Understanding, perception, cognitive dissonance, problem solving and insight are important aspects of learning in cognitive psychology. It is clear that these developments in cognitive theory of learning also support the use of problems in learning. In PBL, learners refine and restructure their prior knowledge and experience to construct new knowledge, through collaborative and self-directed learning to solve real world problems (Wood, 1987). PBL is also in accordance with Cognitive Psychologists (Mayer, 1983; Chi & Glaser, 1985).

PROBLEM-BASED LEARNING IN CHEMISTRY CLASSES.

Chemistry is a study of nature, composition and properties of matter. Therefore it deals with the study of the entire environment (Ababio, 2005). It is a complex subject with many branches and abstract concepts. Secondary school students often have difficulty to conceptualize it. They do not understand the principle underlying chemistry, because of their inadequate reasoning skills. Hence they are unable to establish relationship between the learning that occurs in the classrooms and their real-life situation. Learning chemistry requires the understanding of three levels of chemical representations: Macroscopic, Microscopic and Symbolic levels. Macroscopic level is the phenomena that can be seen with naked eyes (Boiling of water, heating of sulphur); Microscopic level is the representation of atomic particles that cannot be seen with naked eyes (protons, neutrons and electrons); Symbolic level such as chemical formulae and equations are represented using signs, symbols, coefficients and formulae (Gabel, 1998; Johnstone, 1991; Gkitzia, Salta and Tzougraki, 2011).

Learning chemistry becomes also difficult to secondary students due to alternative conceptions. Alternative conception is the view and meaning of the world acquired by

children before they are formally introduced to science. This is developed as children attempt to make sense of the world in terms of their experiences. The misconceptions held by students are different from scientist views because children have difficulties with abstract reasoning, their interest in particular explanation of scientific events and the use of everyday language of the society. Alternative conception hinders student learning (Gilbert & Treagust, 2009, Osborne, Bell & Gilbert, 1983).

The characteristics and processes of the PBL will take care of these triple levels of chemical representations by explanations of the microscopic level that is instrumental to the understanding of the macroscopic and symbolic levels. These allow student to transfer knowledge from one level to another easily through collaborative and self-directed learning. Similarly, the students' alternative conceptions can also be identified and corrected by teacher facilitation process to foster conceptual understanding of chemistry without hindrance to learning (Delisle, 1997; Gabel, 1999).

CONCLUSION.

PBL is a significant innovation in education, which have real life problems as focal points, teachers as mediating guides, learners as active problem solvers through collaborative and self-directed learning. The learning process produces students with adequate problem solving skills and flexible knowledge base. Learning paradigm has shifted towards attainment of the desired goal of a knowledge-based economy society from the 21st century education. However, despite the paradigm shift to PBL approach that produces students with higher-order thinking skills and other required competences, the traditional lecture method, bad learning environment, inadequate facilities as mentioned earlier are very common in Nigerian secondary schools. The situation is different from western countries where PBL originated and fully implemented. Therefore the authors will investigate the process of implementation of PBL in Nigerian secondary schools chemistry lessons that are suitable and appropriate for Nigerian school context.

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